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Three-dimensional simulation of coastal flow dynamics subject to climatic change

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Climate change is expected to induce sea level rise in the German Bight, which is part of the North Sea, Germany. Climate change may also modify river discharge of the river Weser flowing into the German Bight, which will alter both pressure and salinity distributions in the German Bight. To study the long-term interaction between sea level rise, discharge variations, and coastal aquifer flow dynamics, a three-dimensional saltwater intrusion model was designed using the fully coupled surface-subsurface numerical model HydroGeoSphere. The model simulates the following scenarios: (i) mean sea level rise (MSLR) of 1 m, (ii) decrease of river Weser discharge (yearly average) from 326 m3 s-1 to 200 m3 s-1, (iii) increase of river Weser discharge from 326 m3 s-1 to 2000 m3 s-1, (iv) partial dyke breach due to storm overwash. Results demonstrate that the position of the seawater-freshwater interface as well as drainage discharge will be affected by climate change. The obtained results are useful for coastal engineering practices and drinking water resource management.